SPECIFICATION

BACKGROUND OF THE INVENTION

The present invention relates to web splicers which form an automatic flying splice between a new roll and a web of material running from an expiring roll. More particularly, it is directed to a vehicular transporting and splicing apparatus for rolls of web material wherein a single apparatus may service several unwinding devices. The primary use for the present invention is likely to be printing and converting paper and plastic film, although other materials and uses may be handled using the present technology.

The present manual unwind stand operations on smaller web presses without splicers proceed as follows: when an unwinding roll is essentially depleted, the printing press is stopped, and the web connected to the web-consuming machine is manually severed from the remainder of the roll. The roll and coreshaft assembly is then manually lifted from the unwind stand. A new roll on a dolly is then moved next to the unwind stand and levered up into the unwind position, where it is then hand spliced onto the severed end of the web. The press is restarted and after several minutes of continuously producing waste, production resumes.

These manual operations are time-consuming, wasteful, arduous and injury-prone.

To avoid downtime of the web-consuming machine, two main concepts have been used to design a splicer to connect a new roll to the running web, especially on printing presses. Some use a festoon to store a sufficient length of web to allow a stationary splice to be made, while the depleting festoon continues to supply a moving web.

Other types of splicers, referred to as flying splicers or speed match splicers, make a splice automatically at operating speed by matching the surface velocity of the new roll to that of the expiring web, and rapidly adhering the end of the outer wrap of the new roll onto the expiring web. Most speed match splicers utilize a surface drive on the new roll. This requires that one or two areas across the width of the web be free of adhesive, which allows the high-velocity air used in most dryers to enter this slot in the splice, inflating it and often causing a web-break. Examples of prior art are:

McDonald U.S No. 3,740,296, teaches the use of pivoted arms to support rolls.

Phelps U.S.No. 3,831,876, teaches a core chuck driven roll, and describes the splicing mechanism and ability to splice either the inside or outside of the paper facing upward.

Tafel U.S. No. 4,729,522, uses a surface belt drive with the disadvantage mentioned above, of not having a continuous adhesive pattern across the face of the new roll.

SPLICING VEHICLE

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To overcome on this particular objection, the present invention drives the roll by its coreshaft. An example of this general type of splicer is taught in Martin 5,335,870 which is especially useful for printing presses having only one or two webs, or which are fed at right angles to the pressrow by web turning bars.

Both types of splicing machines are quite large, occupying a volume many times that of the rolls they process. When used with printing presses and converting lines, it is often necessary to reconfigure the entire operation to provide sufficient additional space for these splicers and space to load them. Further, there is considerable expense involved, as one splicer must be provided for every web, and in newspaper applications, multiple webs are customary. Another means of solving the floor space problem has been to stack splicers on top of one another, but this requires operators to climb ladders and work off of platforms, hoisting devices on rails, and all the webs must be strung down to floor level and under the presses.

BRIEF DESCRIPTION OF THE DRAWINGS

Reference is made in the foregoing description to paper and printing, but the same concepts and apparatus may be applied to many different web consuming operations. In the detailed description of the invention which follows, reference will be made to the accompanying drawings composed of the following figures:

Fig. 1 is a pictorial view of the splicer vehicle in its preferred embodiment, showing the splicer vehicle conveying an expired roll. The splicehead arms are raised.

Fig.2 is a pictorial view of the splicer vehicle in its preferred embodiment, conveying a roll into position adjacent to an unwind located under a small printing press.

Fig.3 is a front view of the splicer vehicle at the beginning of a splice cycle, showing the web from a dispensing roll being spliced onto a new roll .

Fig. 4 is a front view of the splicer vehicle in its preferred embodiment, showing its roll lifting arms having moved the newly-spliced roll into dispensing position after having lifted the expired roll up out of the way.

Fig. 5 is a detailed pictorial view of the new roll, the web-repositioning idler-roller, severing knife, and splicehead positioning arm, immediatly after a splice. The view is shown truncated at the centerline

Fig. 6 is a pictorial view showing the roll lifting assembly about to move down and engage the coreshaft of a new replacement roll.

Fig. 7 is an pictorial view of the roll lifting assembly and engaging mechanism in its locked position.

Fig. 8 is a pictorial view of the splicer vehicle adapted to load stacked rollstands.

Fig. 9 is a pictorial view of the splicer vehicle adapted to function with core chucks, rather than a coreshaft. The splicer vehicle is shown conveying a new roll. The splicehead arms are raised and each shown engaging a core chuck.

Fig.10 is a pictorial showing the means of roll axial adjustment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention relates to apparatus to form a flying splice wherein new-rolls of material are supported within a vehicle equipped with a lifting mechanism to lift and position new-rolls, and incorporating a splicing mechanism to splice the outer wrap of material onto expiring rolls in at least one unwind stand. Optional provision is made to retain the rotational direction of the actively unwinding roll before and after splicing, an advantage when using paper having different finishes on each side.

Although the following terminology refers primarily to printing and paper, it must be understood the present invention is applicable to any of a variety of web-consuming devices or materials.

The sequence of operation for the present invention as it applies to paper and plastic film is generally as follows:

In a web printing or converting production line, a web utilizing device is provided with a web from a splicer, or from an unwind stand. In the case of an unwind stand, the present invention provides a means to automatically splice a new roll onto the dispensing roll in the unwind stand, thereby supplying a continuous, uninterrupted web supply to the web utilizing device without the expense of having a splicer for each web.

When it is determined, either visually, or by automatic sensing devices, that the roll dispensing a web is substantially depleted, the present invention provides a vehicular splicer to retrieve a new roll from a storage area and to splice a web from that roll onto the web of the roll being dispensed. The new roll must first be unwrapped and a coreshaft inserted and locked into the hollow core of the new roll, and this assembly is hereinafter referred to as the "second roll assembly". A pair of parallel roll lifting arms then extend from the splicing vehicle and engage each end of the coreshaft and lift ~~it~~ the second roll assembly off the floor and into the interior of the vehicle for transport to a predetermined location next to the roll unwind. Pins are then lowered from the splicing vehicle into sockets in the floor, accurately locating the vehicle.

When the dispensing roll is depleted sufficiently to allow a splice, the roll lifting arms extend to move the new roll from the vehicle until the circumferences of the new roll and the dispensing roll are less than approximately two inches apart and parallel. The splicehead arms then lower the splicing mechanism down over the coreshaft of the dispensing roll. The new roll is then rotated to a surface velocity approximating the velocity of the dispensing web, at which time the splicing roller brackets are pivoted to redirect the dispensing web out of the roll unwind device and against an adhesive area on the outer wrap of the new roll, thereby effecting a splice.

A severing knife then detaches the splice from the expired roll. The new-roll drive motor goes into a braking mode responsive to a web tension indicated by a web-tension sensor mounted in the unwind stand, and maintains web tension at a operator established set-point until the roll is moved into position in the unwind web-stand web, at which time tensioning is provided by the braking means normally provided by the unwind stand. The expired roll is then removed from the press, the roll support arms are retracted, and the vehicle is moved away from the press, supported on its wheels. The arms are then lowered to a convenient height and the coreshaft removed from the splicehead arms for recycling into a new roll.

Referring now to pictorial view **Fig.1** of the splicer vehicle in its preferred embodiment, showing the splicer vehicle **4** conveying a new roll **30** which is loaded into the roll lifting arms **8**. The splicehead arms **17** are raised by linear actuator **22**. The splicer vehicle consists of an operator-side housing **3** with operator control panel and attached computer **6**, and a drive-side housing **5**, all supported on castered wheels **13** and driven wheel **11**. Protruding from the underside are aligning pins **14** and **15** which are lowered into alignment disks **15** having elongated slots which are affixed to the pressroom floor immediatly adjacent to the web-consuming device to provide accurate positioning of the splicer vehicle with respect to that device. Sensor **56** limits the positioning of the new roll during loading and thereby indicates the new roll diameter by referencing the position of arms **7**.

Referring now to pictorial view **Fig.2** , the preferred embodiment is shown moving into a splicing position adjacent to a small web press **1** of common design having an unwind stand **2** beneath it which rotationally supports dispensing roll **23** having coreshaft **19** with brake drum **28** rigidly affixed thereto, hereinafter referred to as the "first roll assembly" so disposed that the brake regulates the web tension in the convenional manner of a rollstand by referencing a dancer-roll position**59** with sensor **58**. New roll **30** is shown mounted into the splicing vehicle with a splice pattern **16** already prepared . Signals between the vehicular splicer and web consuming device are transmitted between a transceiver in the vehicular splicer control-panel-computer assembly **6** and a transceiver **50** on the web-consuming device. Sensor **51** indicates the RPM of the new roll and sensor **52** indicates the RPM of splicing roller and thus the web speed. Sensor **53** indicates RPM of the driveshaft **54** of the web-consuming device **1**. Sensor **55** located on the vehicular splicer indicates the RPM of the new roll assembly.

Fig.3 is a front view at the beginning a splice cycle. New roll **37** illustrates the smallest new roll that may be accommodated, and new roll **30**, shown in phantom lines, illustrates the largest roll that may be accommodated. The roll-lifting arms **8** with their roll retaining latches activated by actuators **36**, have been moved into the splice position by the rotation of pivoting arms **7**. The splicehead-arms **17**, each raised and lowered by contraction and extension of

linear actuator 22, and each having a splice roll bracket 20 operated by actuator 21, acting in combination to support splicehead shaft 46 at each of its ends, including the resilient splicing roller 18 and severing knife 42 supported thereby. The splice roll bracket 20 ~~is shown~~ is shown (in bold lines) as the splicing roller first contacts dispensing web 29 and also in a second position, in phantom lines, after it has rotated approximately 90 degrees of revolution to press the dispensing web against the adhesive area on the new roll 37, thereby effecting a splice between the web from the dispensing roll and the outer wrap of the new roll. Operative rotation of severing knife 42 by shaft 46 then detaches the web from the dispensing roll in the unwinding stand to complete the splice cycle, whereupon the splicehead arms and splice roll bracket 20 acting in combination with the splicing roll 18, grasp and remove this roll from rollstand support bearing- ~~17~~ saddles 24 to the location shown over the top of the vehicle. The splicing vehicle 10 is then moved to a location where the arms can be lowered and the coreshaft removed.

Referring now to front view Fig.4, the pivoting arms 7 and lifting arms 8, move collectively and in unison to place the new roll coreshaft 19 and new roll 30 into bearing saddles 24 . Acting collectively and in unison, brake arms 38 then operatively rotate together and cause the brake pads 27 supported thereby, to grasp brake drum 28 and thereby restrain its rotation, and causing tension to be maintained in the dispensing web 29.

Pictorial view Fig. 5 shown truncated at the centerline of the apparatus, illustrates the splicing elements in enlarged detail, immediatly after splice 25 joined the end of web 41 from expired roll 18, to exiting web 29 from the new roll 30. Splicing roller brackets 20 are preferably pivotably supported by splicehead arm 17, and are caused to pivot by splicing roll linear actuator 21. Shaft 46 rotatably supports roller 18 by bearings 47 on which are also positioned splicing roller brackets 20. Knife 42 is affixed to clamping blocks 45, which rigidly clamp onto operatively rotatable shaft 46. Upon operative rotation of said shaft, the dispensing web is severed. The hooked shape of bracket 20 aids in confining and subsequently grasping the coreshaft 19.

Fig. 6 is a pictorial view showing the roll lifting assembly just prior to moving down and engaging the coreshaft 19 of a new replacement roll 30. Actuator 36 has retracted, which rotates triangular block 35 Counterclockwise about pin 26. Toggle link 34 which is rotatably attached to the triangular block , pulls on roller link 32, causing it to rotate into an open position to accept the coreshaft 19.

Fig. 7 is an pictorial view of the roll lifting assembly in the clamped condition. The coreshaft is omitted for clarity. Actuator 36 has extended, rotating triangular block 35 clockwise about pin 26. Toggle link 34 which is rotatably attached to the triangular block , pushes on roller link 32 and toggles over-center, causing the roller link to rotate into a closed position to grasp the coreshaft 19, and to remain locked in that position in the event the energy source to the actuator is accidentally interrupted. The coreshaft is supported between rollers 31, which are arrayed in a triangle.

Fig. 8 shows a two-high stacked rollstand being serviced by a modification of the basic design, wherein the lifting and splicing mechanism 39 is supported on an elevating track mechanism 44. A significant advantage of the present invention is that, after the new roll is loaded into the splicing vehicle, the splicing and core retrieval process requires no operator.

Pictorial view Fig. 9 of the splicer vehicle, shows the splicer vehicle 4 conveying a new roll 30 having core chucks 48 inserted into each end of the roll core. Core chucks are commercially available of various designs. One type is the so-call self-actuating chuck which has a torque sensitive mechanism that expands the chuck inside the roll core responsive to a driving or braking torque [,] _._ Other types of chucks are operated either mechanically or by pneumatics. In the present invention, the core chucks are being rotatably supported in roll lifting arms. The chuck arms 47 with chuck bearing housing 49 are shown raised, with each arm holding a core chuck for subsequent insertion into a new roll.

Pictorial view Fig. 10 shows automatic axial roll positioning means to align with the new roll to the dispensing roll. When splicehead support arms 17 (in Fig.2), supporting edge sensor 59 are partially lowered, the face of the dispensing roll 23 (in Fig.2) is detected. Servo-motor 60 then turns screw 61 which pulls link 62, causing pins 63 which engage arms 64 to rotate said arms about pivots 65, said arms also supporting tapered alignment pins 14. Said tapered alignment pins have been inserted into alignment disks 15 which are rigidly located in the floor and act as a fulcrum whereby the rotation of said arms 64 causes the splicing vehicle 4 & 5 to be repositioned along the axis of the new roll until sensor 59 detects the edge of roll 23.

The foregoing description of the preferred embodiment of the invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed. Many modifications and variations are possible in light of the above teaching. It is intended that the scope of the invention be limited not by this detailed description, but rather by the claims appended hereto.